to be wheeled about his room, and even to be carried into his garden and to be taken for carriage drives, but in January, 1906, he broke his leg, and was again entirely confined to his bed. The numerous pencilled letters that I received at this time showed unabated cheerfulness and delight in his work. On July 17th, 1905, he wrote: "What troubles me most is that I have such a vast lot of half worked-up scientific material, which takes me longer time than I could have expected to get into shape, and I fear I may never be able to finish it," and many subsequent letters expressed the same anxiety. He was able, however, to complete the paper "On the Application of Quantitative Methods to the Study of the Structure and History of Rocks," which is now being published by the Geological Society, to send a note to *Nature* on the colouring matter of flowers, and also to make some short communications to local journals. He was greatly cheered when he heard of the reception of his paper, and by the kind message from British and foreign geologists, to which he replied by sending copies of his portrait to those who had signed it.

Early in March Sorby's illness assumed a more alarming form, but he was cheerful and busily engaged in discussing scientific problems till within a few hours of his death, which took place on March 9th.

His best epitaph would be that written by himself: "My entire life has been spent either in scientific research or in preparation for it."

JOHN W. JUDD.

II.—NOTE ON *DINODOCUS MACKESONI*, A CETIOSAURIAN FROM THE LOWER GREENSAND OF KENT.

By ARTHUR SMITH WOODWARD, LL.D., F.R.S.

IN 1840 Mr. H. B. Mackeson discovered a group of bones of a large reptile in the Lower Greensand near Hythe, Kent; and in the following year the specimen was briefly noticed by Professor (Sir Richard) Owen, who provisionally referred it to the genus *Polyptychodon*.[1] The fossil was presented by Mr. Mackeson to the British Museum, and ten years later the bones were described in detail by Owen,[2] who recognised that they agreed most closely with those of the Jurassic *Cetiosaurus*, but still thought they might belong to the 'crocodile' whose teeth were known as *Polyptychodon*. Subsequent discoveries proved that *Polyptychodon* was a Pliosaurian, with limb-bones quite different from those of the Hythe fossil reptile,[3] and Owen eventually realised that the specimen represented a species of Dinosaur, to which he gave the undefined name *Dinodocus Mackesoni*.[4] Without adding to our knowledge of *Dinodocus* Lydekker[5] placed it in the family Cetiosauridæ, while Marsh[6]

[1] Proc. Geol. Soc., vol. iii (1841–2), pp. 325, 451; also Rep. Brit. Assoc., 1841 (1842), p. 157.

[2] "Rept. Cret. Form." (Mon. Palæont. Soc., 1851), p. 47, pls. xii, xiii, and woodcuts.

[3] H. G. Seeley, Quart. Journ. Geol. Soc., vol. xxxii (1876), p. 436.

[4] "Hist. Brit. Foss. Rept." (1884), index to vol. ii, p. ix.

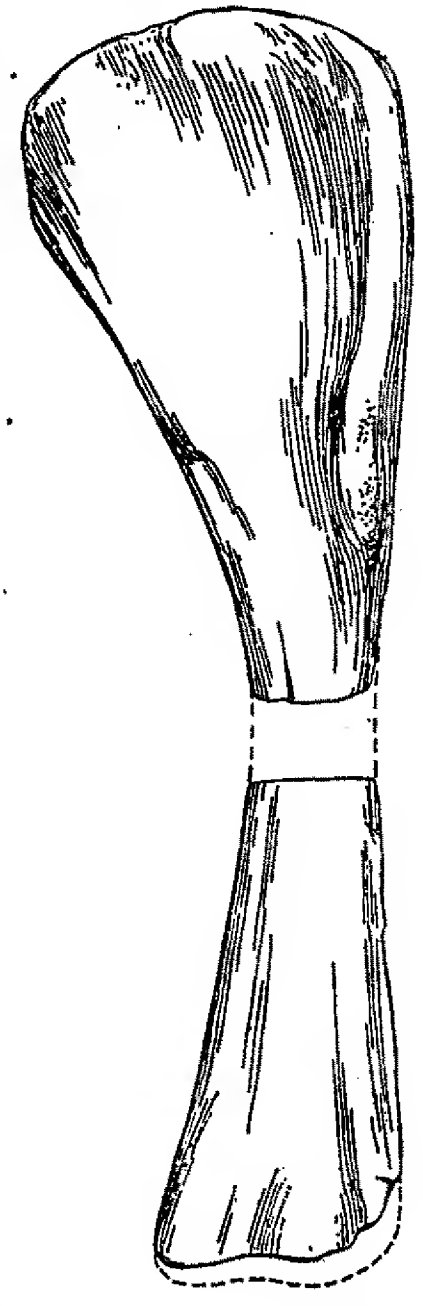
[5] "Catal. Foss. Rept. Brit. Mus.," pt. i (1888), p. 136.

[6] GEOL. MAG., Dec. III, Vol. VI (1889), p. 206.

agreed that it was truly a Sauropodous Dinosaur, though of uncertain affinity.

The remains of *Dinodocus* are very fragmentary, and Owen records that owing to the difficulty of extricating them from the matrix they were "less characteristic" when they reached the British Museum "than when [he] took the description and sketches of them on the spot where they were found." The published description, in fact, gives no clear idea of the nature of the bones, and they can only be interpreted by discoveries which have been made since it was written.

The task of determining all the bone-fragments would be more laborious than profitable, but a careful study of the collection has proved that some of them can be united into two important elements, the humerus and the ulna, which are specially worthy of notice. These are now mounted for exhibition in the British Museum, and the humerus is represented in the accompanying text-figure.



Anterior aspect of left humerus of *Dinodocus Mackesoni*, Owen, from the Lower Greensand, near Hythe, Kent; $\frac{1}{15}$ nat. size. [Brit. Mus. No. 14695.]

The upper half of the left humerus is shown in Owen's pl. xii, fig. 6, and described as a "fractured portion of the ilium." The bone itself is in small pieces, but there is a perfect mould of its anterior face in the hard Greensand matrix, so that at least this aspect can be completed in plaster. The lower half of a humerus is described and figured by Owen (loc. cit., p. 48, pl. xii, fig. 1) as "lower end of shaft of femur"; but its surface is so much fractured and the distal end is so incomplete that it is not easy to determine whether the specimen belongs to the right or to the left side. On the whole, I am inclined to refer the bone to the right side, and have reversed the drawing of it in the accompanying figure. The two halves do not quite meet in the middle, the lower fractured end having been ground to display the nature of its cross-section. As remarked by Owen, the bone is solid, but the cancellous interior is of so open a texture that it might readily disappear in a fossil. The extreme length of the humerus must have been originally about 1·25 m., the width of its upper end 40 cm., and the width of its lower end not less than 30 cm. Its upper end is deeply concave on its anterior face, the deltoid crest being specially prominent. The shaft is slender, and the lower end, which lacks a few centimetres in the fossil, shows the usual prominence on the anterior face above the outer condyle.

A fragment of the upper end of the right humerus fits on the impression of its anterior face, which is correctly identified by Owen (loc. cit., pl. xiii, fig. 2, H).

Impressions of the right ulna and radius are preserved on the slab of Greensand described by Owen as exhibiting the shaft of a tibia and the lower end of a fibula (loc. cit., p. 49, pl. xiii, fig. 1). The ulna, which seems to lack only a short piece at its upper end, is a relatively stout bone about 60 cm. in length. Its upper portion is trihedral, with each of the three faces a little indented in the middle and measuring respectively 13, 15, and 17 cm. across. One view of it is drawn, upside down, in Owen's pl. xii, fig. 2, as a "lower end of shaft of humerus." A fragment of this region, showing the posterior indented face and two angles, is also represented in cross-section by Owen in his text-fig. 2, p. 50, as if it were complete, while the extent of the central loose tissue is hypothetically and erroneously shaded. Further down the cross-section is nearly as shown in Owen's text-fig. 1, p. 50. The distal end, which is complete and exhibits the usual pitted surface for a cap of cartilage, is represented by Owen in his text-fig. 6, p. 51, while the cross-section 15 cm. higher up is given in text-fig. 7, p. 51. The bone is less expanded at the upper end than in *Cetiosaurus* and *Morosaurus*. The radius itself is not preserved, and only the upper half of it is seen in impression. It evidently conforms to the Cetiosaurian pattern.

Of the other fragments of *Dinodocus*, it suffices to remark that none of them are metatarsals or other foot-bones. The specimen shown in Owen's text-figs. 10 and 11, p. 52 (also in pl. xiii, fig. 5), suggests the distal end of a fibula.

It is thus evident that *Dinodocus* is a large Sauropodous Dinosaur, with a remarkably slender fore-limb. In its slenderness the humerus differs from that of *Cetiosaurus* and *Morosaurus*, while agreeing exactly with the Wealden humerus named *Pelorosaurus* by Mantell.[1] There is, in fact, no justification at present for regarding *Pelorosaurus* and *Dinodocus* as distinct genera. As already remarked by Seeley,[2] the Pelorosaurian humerus probably belongs to the same reptile as the Wealden vertebræ named *Ornithopsis*. The latest large Sauropodous Dinosaur seems, therefore, to have been more slightly built and more active on land than the *Cetiosaurus* of earlier date.

III.—On Changes of Level and the Production of Raised Beaches.

By T. F. Jamieson, LL.D., F.G.S.

I HAVE occasionally drawn attention to the effect produced on the relative level of sea and land by variations of pressure on the surface, such as would be occasioned, for example, by the increase or diminution of the loads of ice which existed during the Glacial period. I argued that the position of the surface must be always tending to an exact equilibrium between the upward and the downward pressure, and that any variation in the superincumbent load must result in some

[1] Phil. Trans., 1850, p. 379.

[2] Quart. Journ. Geol. Soc., vol. xxxviii (1882), p. 371; also Geol. Mag., Dec. III, Vol. IV (1887), p. 479.